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# Invisible Social Infrastructures to Facilitate Time-pressed Distributed Organizing

Paul C. van Fenema and Christine Räisänen

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**ABSTRACT.** How do complex societal demands and time constraints posed by distributed temporary organizing affect organizational communication? Extending Bowker and Star's (2002) work on infrastructures, we introduce two context-specific 'invisible', social infrastructures: organizational and relational. We empirically assess their role in an international, multi-site ERP-software implementation. We investigated how these infrastructures shaped organizational activities, aligned discourses, created order, and prevented divergent behaviours. We found that mutually interdependent organizational and relational infrastructures strengthened social relationships and saved time by facilitating non-routine collaboration and organizational communication under geographic and temporal constraints. We argue that the conceptualization of (infra)structural and process dynamics will help researchers and practitioners understand and handle organizational communication in distributed temporary organizations. **KEY WORDS** • distributed organization • infrastructures • organizational communication • time constraints • time-space

## Introduction

Distributed temporary organizations<sup>1</sup> are becoming prevalent organizational forms in today's increasingly interconnected economic systems, where business dynamics and globalization fuel faster and more international product life cycles (Fulk and DeSanctis, 1995; Lundin and Söderholm, 1995, 1998; Meyerson, Weick and Kramer, 1996). This type of organizing frequently

extends over geographic and cultural boundaries, involving different social environments. Distributed temporary organizations are often characterized by innovative, complex technologies, and they entail coordination and learning over short periods of time. Therefore, like all projects, they face challenging constraints such as rigid time horizons, limited budgets, and predetermined requirements (PMI, 1999). In addition, distributed temporary organizations have to deal with physical distances, different time zones and cultural diversity.

This article focuses on how distributed project organizations experience and deal with social complexity and time constraints. We empirically studied a Y2K project where a rigid, non-negotiable deadline translated into considerable time pressure and mental stress to finish the project according to schedule. This in turn put heavy demands on the social arrangement of the distributed project.

Research has shown that time pressure affects communication and organizational activities. In distributed projects, time-zone differences reduce windows for collaborating remotely (Jarvenpaa and Leidner, 1998; Boland and Citurs, 2001; van Fenema, 2002). Furthermore, physical distances alter and limit the frequency and richness of interactions (Kraut and Galegher, 1990). Since these constraints can jeopardize organizational performance, it is important for researchers and practitioners to obtain an integrative understanding of distributed project organizing under time constraints.

To date, research on distributed projects has mainly focused on the codification and formalization of work processes (Ciborra, 1996), the use of electronic media (Lee, 1994; Majchrzak et al., 2000), and impacts of time-zone differences (Jarvenpaa and Leidner, 1998; Boland and Citurs, 2001). The insights derived from these studies offer glimpses into a new era for project-management science. However, they do not specifically and systematically address how organizations handle communication over dispersed social environments under considerable time pressure. Many studies seem to assume that people will have time for (virtual) socialization and adjustment of work practices. Less attention has been paid to distributed organizations that must 'hit the ground running'. This challenge has been the driving force of our study.

We define organizational communication as the formal and informal communicative activities that constitute interpersonal collaboration processes. We see organizational communication as the glue that binds the technical system to the social system in an organizational ensemble. Communication activities embody work processes, particularly in temporary projects, which are commonly characterized by considerable information processing needs (Galbraith, 1973; Bryman et al., 1987).

Our point of departure is Bowker and Star's (2002) concept of infrastructure and how this concept may relate to distributed and temporary organizing. We extend the concept of infrastructures to include organization-specific rules and resources, both explicit and implicit. Along these lines, we distinguish two

types of mainly invisible infrastructures that influence distributed organizing: organizational and relational infrastructures. These infrastructures are predominantly social in nature, not technical. Empirically, we assess the value of these ideas in the context of a single case study conducted at a multi-site corporation that implemented package software, ERP. The project's fixed deadline (Y2K) translated into considerable time pressure. The article concludes with a discussion of the implications for practice and research.

### Infrastructures

Bowker and Star (2002) explore the roles of categorization, classification, coding systems and standardization in a variety of professional contexts. For instance, they show that the classifications of diseases become part of implicit infrastructures that shape current and future human thinking and acting. Classification can materialize in a visible (check)list, or a genre that is part of the repertoire of organizational discourse (Yates and Orlikowski, 1992). These infrastructures embody activities that, over time, reflect notions of good, or at least commonly accepted, social practice. As such they promote international comparison and exchange of data. Categorization and standardization (both constituting infrastructures) support the generation, bridging and aligning of social and discursive practices in and between different groups (Engeström, Engeström and Kärkkäinen, 1995; Leander, 2002). The idea of an infrastructure represents here a more specific notion than (organizational) culture. Culture is often associated with a variety of context-specific activities ('the way we do things around here' (Weick and Stuclicke, 2003)), and includes broader notions of identity, imagery, artefacts, and power. Infrastructure, on the other hand, is used here in the specific sense of facilitating organizational enculturation and communication. As will be elaborated, we focus on the role of infrastructure in enabling time-pressed collaboration.

We use the Øresund Bridge between Denmark and Sweden to illustrate the richness of the infrastructure metaphor (see Figure 1):

Danes and Swedes have always crossed the Øresund in order to work or recreate [sic] on the other side. Until 2000, the only way of crossing was by ferries. In 2000, the Øresund Bridge was inaugurated. This meant a shift in traffic patterns as the bridge offered better and faster connections. The total traffic across the Øresund increased 63 per cent in the first year after the inauguration. (Crossing the Øresund, <http://www.copcap.com/composite-1396.htm>)

The bridge is not only a manifest, utilitarian time-saving and society-linking infrastructure; it is also an aesthetic architectural artefact and an icon of innovative technology – the inscription of the temporal and spatial mindset of the



Source: <http://osb.oeresundsbron.dk>; from the 2003 Bridge Run.

**FIGURE 1**  
**Øresund Bridge between Denmark and Sweden**

temporary organization responsible for its realization. It is a structure that reflects the multi-modality of our time in that it is both bridge and tunnel, serving all types of vehicles. Metaphorically it unites two sides, bridging the gap that divides them, and forging a path into the unknown. It can also be seen as a link between past and future societies. The Øresund Bridge, thus, embodies both a visible and an invisible infrastructure. Most certainly, the bridge saves time. Instead of taking a ferry, or hiring a boat, people can cross what can be considered a gap of *in-between* space without interrupting their speed of movement. This infrastructure enhances people's capabilities and enables new ones, such as walking from Denmark to Sweden. It promotes continuity of connectivity and performance despite constraints, thereby reinforcing economic use of time. Infrastructure reduces 'idle' time spent on, for instance, figuring out how to cross the gap, or waiting for a ferry.

In our current knowledge society, infrastructures are often invisible. They have become mutually interdependent, forming a network of crisscrossed 'Lilliputian threads' (Bowker and Star, 2002: 34) that support human inter-

action. Bowker and Star have defined infrastructures as possessing the following characteristics (p. 35):

- *Embeddedness*: Infrastructure is sunk into and dependent on, other structures, social arrangements, and technologies;
- *Transparency*: Infrastructure is transparent to use in the sense that it does not have to be reinvented each time or assembled for each task, but invisibly supports those tasks;
- *Reach or Scope*: This may be either spatial or temporal – infrastructure has reach beyond a single event or one-site practice;
- *Learned as Part of Membership*: The taken-for-grantedness of artefacts and organizational arrangements is a *sine qua non* of membership in a community of practice. Strangers and outsiders encounter infrastructure as a target object to be learned about. New participants acquire a naturalized familiarity with its objects as they become members;
- *Links with Conventions of Practice*: Infrastructure both shapes and is shaped by the conventions of a community of practice; for example . . . generations of typists have learned the QWERTY keyboard; its limitations are inherited by the computer keyboard and thence by the design of today's computer furniture . . .;
- *Built on an Installed Base*: Infrastructure does not grow *de novo*; it wrestles with the inertia of the installed base and inherits strengths and limitations from that base . . . failing to account for these constraints may be fatal or distorting to new development processes.

Following a structuration theory perspective, infrastructures – as an example of structure – relates to organizational communication – as agency – in a dualistic manner (Orlikowski, 1992). Infrastructure shapes discourses and genres in different settings at different times (people using similar concepts in different contexts), thus acting at a distance (i.e. infrastructure equals communication). Simultaneously, specific enactments of discourse maintain, extend and build infrastructures over time (Feldman and Pentland, 2003), thus communication equals infrastructure. In other words, infrastructures shape the 'traffic' from one social environment to another, and in turn are themselves shaped or altered by the 'traffic'.

For projects, standards and categories are examples of infrastructures that coordinate individual accomplishments. They increase the coherence and consistency of organizational texts (for instance, standards of measurement, or project-management models). At the same time, classification excludes non-standard expressions of thinking and working and as such may impede the creation of novel communication channels and modes. Deviation from infrastructure costs time and is therefore often considered undesirable. Infrastructures reduce 'idle' time and promote acceleration of activity execution (time

compression). The notion of infrastructural deviation presupposes that people subscribe to the same interpretation of an infrastructure, which may not always be the case. Acceptability of infrastructure cannot be assumed in a globalized society with diverse actors. What may serve as a facilitating infrastructure for one person or project may be a barrier for another person, project, or group (Bowker and Star, 2002; Räisänen and Linde, 2004).

Before elaborating on types of infrastructures, we should note that they do not operate as stand-alone entities. They cluster and mutually reinforce each other. People enact multiple structures while performing their tasks (Sewell, 1992). The amplifying effect of infrastructures makes them powerful and important to study. For projects, infrastructures together with their embedded repertoire of genres form a tacit, invisible dimension that helps explain organizational communication (Yates and Orlowski, 1992). In the following section we expand Bowker and Star's (2002) work to include other types of infrastructures. We can then assess the roles of these infrastructures in time-pressed distributed temporary organizations.

### **Organizational and Relational Infrastructures**

Bowker and Star's (2002) initial concept of infrastructures referred to categories and classification systems on a societal and international level. An example is the International Classification of Diseases (ICD). Like language and measurement systems, this category of infrastructure is mostly impersonal, non-relational, and independent of a specific organization or group. We extend the concept of infrastructure to cover areas that are not included in Bowker and Star's concept and thus suggest an even richer categorization of infrastructures that includes two types: organizational and relational.<sup>2</sup> This permits us to refine our investigation of the relationship between infrastructures and organizational communication, and to assess the implications of infrastructures for dealing with time constraints.

#### **Organizational infrastructure**

The literature in semiotics, organizational knowledge and organizational communication draws attention to individuals' internal knowledge bases to understand collective behaviour. Clark (1996) uses common knowledge as a concept to explain the connection between shared internal cognitive structures and interpersonal communication processes. In a similar vein, Grant (1996) distinguishes four categories of common knowledge that support integration of individual performances: language; other forms of symbolic communication like computing structures; commonality of specialized knowledge; and shared meaning

in the form of common narratives. Most of this work focuses on the cognitive structures and their implications, and less on the context of these structures. We would like to initiate a discussion of context by conceptualizing organizational and relational infrastructures based on current research in these respective areas. Organizational infrastructure is carried by and operates in a specific contextual setting with a more distinct horizon than the generic infrastructures introduced by Bowker and Star (2002). At the same time, as noted earlier, infrastructure carries a more specific connotation than organizational culture. Organizational infrastructures thus encompass mental structures (Giddens, 1979). To the extent that these structures are related and possibly shared, they enable time-pressed collaboration.

### **Relational infrastructure**

Gabarro (1990) presented results from research on working relationships. He showed that the more extensive relationships are, the more individuals experience increased commitment and the more predictable, economic, and meaningful communication will be.<sup>3</sup> People develop shortcuts through which they can communicate effectively and efficiently. Weick (1993) gave an example where a strongly bonded sports team was capable of surviving in extremely arduous circumstances after their plane crashed in the middle of nowhere. Team members rapidly regrouped and structured their novel circumstances while drawing on a relationship infrastructure. John-Steiner (2000) presented research on close relational collaboration that characterizes couples working in science and art. These people's activities are characterized by unique interpersonal dynamics and structures that have evolved – after years of interacting – into an implicit supporting infrastructure. Relational infrastructures imply that mutual expectations are implicitly constructed – for those forming the relationship. People can take many things for granted and assume they can anticipate to an extent their counterpart's behaviour. Relational infrastructure eliminates many of the probing communications characterizing interpersonal communications around complex work.

To conclude our conceptual background, invisible infrastructures – organizational and relational ones – pervade collaborative systems. They do not act independently of the context in which they operate, but grow over time, becoming intertwined and mutually supportive, and may even become obstructive (that is, giving rise to inertia). Infrastructures accelerate, influence, and partially substitute for communications in the form of shortcuts, taken-for-granted assumptions, and unspoken shared rules. Infrastructure reduces ambiguity by reducing the variation of interpretations and expectations concerning situations, practices and co-workers. As collaborative work progresses, people draw on and build infrastructures in their own minds, in human counterparts, and to some extent in



artefacts and texts (post-it notes, contact lists on a computer and so on). Most of these dynamics and economizing effects are invisible because the infrastructure itself is largely invisible, and because processes are transitory. Visible artefacts and observable behaviours show merely a glimpse of infrastructure-intense processes.

The importance of infrastructures for understanding how organizations deal with time pressure warrants an empirical investigation and the case study presented here.

## **Methods**

We report on a single case study that illustrates the theoretical argument we build (Eisenhardt, 1989). Our unit of analysis is the distributed project as a multi-site temporary organization. While participating in the case study setting, we adopted a current and retrospective-longitudinal perspective, building on people's retrospective narratives and assessment of their current situation (Pettigrew, 1990; Yin, 1994).

### **Research setting**

DiskCo is an information storage company with worldwide manufacturing, distribution and sales organizations. The company is headquartered in the USA, with R&D facilities in several states. Manufacturing is concentrated in the Far East with sites in China, Malaysia, Japan, Thailand and Singapore. The regional headquarter for the Far East is in Singapore, where most of the empirical data collection was concentrated. This study concerns the implementation of an Oracle ERP system worldwide. The project was initiated in the USA, after which European and Far East sites followed. The multi-module application replaces systems in different functional areas, like finance, logistics and manufacturing. DiskCo selected the Oracle package in 1995 after a lengthy preparatory phase. The system had to work by mid-1999 because of the Y2K (Year 2000) problem. The deadline was non-negotiable. Prior to the implementation project, DiskCo used an application called MANMAN (Manufacturing Management). Local IT units maintained and customized this system for their users. Oracle implied that a novel, integrated system was to be adopted. This research focuses on the final months of the project: implementation of Oracle ERP in the Far East.

## **Data collection**

The Data collection was meticulously planned in advance. A comprehensive manual specified research goals, questions and procedures for collecting, organizing and reporting data. A short version of our research context, objective and procedures was communicated in advance to DiskCo. Data was collected at the Singapore site A, DiskCo's regional headquarters in the Far East region.<sup>4</sup> Contact with our point of access (the Vice President IT in Singapore) was arranged by a local university.

To enable triangulation, data sources included semi-structured interviews, site observations, photographs, demonstrations of the corporate Lotus Notes application, access to DiskCo's intranet and corporate documentation. Being on site provided us with a unique view of people's physical workspace, their local work behaviour, and remote tele-conversations.

Interviewees were selected on the basis of their participation in the Oracle project. We interviewed key representatives from the IT department, Singapore, and key users as representatives from various user departments. This ensured a broad scope within our limited time frame for data collection. Interviews were conducted face-to-face with people working at Singapore site A, and through tele-conferences with DiskCo professionals in Malaysia and another Singaporean site.

We 'managed' interviews carefully in terms of process and content, following a structured and systematic procedure based on an interview guide. Interviews lasted on average one hour each. In terms of content, we focused on coordination and learning processes in a distributed project such as the Oracle implementation. Research and interview protocols ensured focus and consistency. Interviews were taped and transcribed in full. Most data were digitized and centrally organized to enhance accessibility.

## **Data analysis**

We constructed a digital environment that facilitated data sorting, colour-coding of themes and rapid data access and collocation. With this digital infrastructure, we adopted qualitative analysis techniques such as pattern matching, explanation building and time series (Miles and Huberman, 1994; Yin, 1994). With the first technique, we compared patterns from our literature section with those found in our empirical data sets, and built explanatory effect matrices or causal networks as described by Miles and Huberman (1994). This conceptual procedure interwove data with current literature such that novel insights and a more generic understanding emerged (Lee, 1991).

## Findings: Invisible Infrastructures and Temporal Acceleration

In this section we present results from our empirical research on the DiskCo software implementation project. We structured our findings according to the two categories of infrastructures: organizational and relational. As we will show, these infrastructures have multiple accelerating effects on communication in distributed organizations.

### Organizational infrastructure

Organizational infrastructures refer to practices, norms and collaborative know-how anchored in a social system and the individuals taking part in it (Hutchins, 1991). This section elaborates on two types in the DiskCo case: who-does-what knowledge and norms for pacing communications. Each accelerated socialization and collaboration processes

#### *Infrastructure as who-does-what knowledge*

Who-does-what knowledge is important for channelling organizational communication. DiskCo emphasized that people working on the Oracle project were only recruited from the existing organization. This contrasts with the notion that temporary work requires a temporary workforce (Bryman et al., 1987). The common history of project participants reduced much uncertainty in the organization of the ERP implementation. It created a temporal advantage in the sense of already embedded routines and established work practices. Shared history and work culture reduced the need for building new infrastructures for collaboration (Watzlawick, Beavin Bavelas and Jackson, 1967). It enabled people to channel their efforts into handling new challenges brought about by the new technology:

We have one advantage over here and that is the whole history. We start off with only this plant [Singapore site A]. Then we go to China and start this [China site A] plant. We are the ones who go there and pick the IT people, good IT people. We train the people, set up the infrastructure, everything, and hand it all over to local IT. So the good thing about the IT team here [Singapore site A] is that on average they have been with [DiskCo] for eight years. I have had staff with me for a long, long time. And that helps a lot, because their knowledge and what they know, who are the people they know, is all there. (Vice President Information Technologies, CPW, DiskCo-A-3)<sup>5</sup>

When people work together for a while, they develop organizational knowledge, also referred to as collective knowledge (Spender, 1995) or transactive memory (Wegner, 1987; Moreland, 1999). They can mentally depict the organization, knowing who does what. In the Oracle project, this proved beneficial for resolving issues across organizational units. People knew who to contact when

problems occurred, and who to escalate to if need be. For temporary projects such time-saving resources are crucial in order to reduce the stress and pressure that tight deadlines impose. A key user from Singapore described her knowledge of the DiskCo organization as follows:

If there is any issue we will contact the manager, that's the final person. If we cannot get anybody, we will look for the manager . . . We know the local manager, we know roughly the organization, because I visited them before. So I know them, I know their manager, and who is doing what in their sections. It's a sort of knowing whom to communicate to when I have any issues and so on. (Key User, Finance, ST, DiskCo-H-1)

DiskCo codified their transactive memory through electronically distributed contact lists that fulfilled the functions described below by one of the interviewees. Since these lists represented real people and not merely virtual contacts, employees did not procrastinate in seeking consultation:

We need to know the name list of the supporting group from the other site: what are their names and what are their main projects and main areas that they are covering. And in their absence who would be the backup person. And also who are their bosses. I think the name list is very important. (Key User, Inventory Control, ET, DiskCo-K-1)

Contact lists included US counterparts so that a comprehensive organizational representation was achieved. Collaboration processes followed this infrastructure and became less random and time consuming. Distribution among IT and users enhanced organizational transparency, facilitated communication and helped people to sustain the project tempo (Adler and Borys, 1996). The organizational infrastructure that underpinned collaboration processes accelerated the relevance of personal connectivity and reduced 'transaction costs'.

### *Infrastructure as norms for pacing communications*

Shared history promoted convergence of norms and rules, such as communication pacing (Schein, 1992). After a while, people tend to develop and use – often implicitly – similar rules for working in the organization. At DiskCo, people maintained a regular pacing of communication. This informal procedure had evolved over years. It became an organizational routine that was automatically adopted in the Oracle project:

In the Eastern environment [DiskCo Far East] we have been working together for a long time, so that we have already established some reporting mechanisms and some expectations. Like for example, when you talk about the conversion, I will expect my director to give me voice mail at every stage of the conversion. They will give me a voice mail and report the status. And as I say, every week we have a meeting. We check the status and cover all areas. Like myself and my boss – the CIO now, he has worked here for two years – we had a norm that during my con-

version [an earlier IT implementation project] every two–three hours I will leave him a voice mail . . . So that is a standard practice, a procedure we need there. (Vice President, Information Technologies, CPW, DiskCo-A-3)

The research at DiskCo showed regularity of communication at local, regional (Far East) and global levels. First, local meetings connected people within departments, like the IT core team in Singapore, or people within a user department. The intensity of their communicative needs set the pace of meetings. Regular communications connected people independently of specific issues that may arise during their work. It reduced (not necessarily eliminated) *ad hoc* meetings and thus adaptive coordination efforts. As the project progressed, meetings became less frequent – from daily to weekly.

Second, regional meetings connected people from different sites in the Far East. At least before the project started and during the actual conversion period, people travelled on a regular basis from Singapore to other Far East sites. This pacing ensured that during the most critical moments key people were present. It prevented misunderstandings, *ad hoc* panic communication and extra trips:

It is important that we have a lot of these staff meetings, weekly [local] meetings for the project. And I personally go down there and feel the ground. And every conversion, the actual conversion, I'm always there one week before. And I stay up to one week later. So the week before I can be there, when I see anything I do not like I need to mobilize some people from here [Singapore site A]. And the good thing within Asia is that in one day you can reach most places. No major itinerary. (Vice President, Information Technologies, CPW, DiskCo-A-3)

In addition to visits, remote conference calls were organized weekly. All IT directors in the Far East region would call in to the Singapore office to report their status and discuss pending issues. This regular pattern provided the Vice President of Information Technologies in Singapore with a theatre-level awareness (Perla et al., 2000): first *ad hoc* discussions and meetings with local directors, then fine-tuning actions and the coordinating process. Staff at the Singapore headquarters regularly updated their counterparts at other Far East sites by electronically providing them with information on new standards and topics. Alternatively, people visited sites at regular intervals to feel the ground and complement the perceptions they had built through remote communication.

Third, regular global meetings were set up to orchestrate operations across the DiskCo organization. IT executives from across the globe would fly into US headquarters to discuss operations and achieve international coordination. This regularity promoted focused coordination and knowledge exchange and reduced mismatches and communication breakdown at *ad hoc* meetings:

Of course [remote communication] is not as effective as local meetings. So we also have at least once every two months a so-called worldwide meeting in the USA, where all the various site directors will have to fly in to the USA to have a

meeting there. Not all directors actually, but representatives. Like for [Singapore site A] normally CPW will have to be there for all these meetings. (Director of Applications Development Information Technologies, HHT, DiskCo-B-1)

During the Oracle project, these face-to-face visits were supplemented by worldwide conference calls, much like the regional ones. Executives from the Far East, Europe, and the USA participated in weekly global tele-conference calls to share results and maintain paced coordination at an international level. Pacing communications on local, regional and global levels regulated communication processes. Investments in these meetings were compensated by the reduction of *ad hoc* travelling and remote communication.

### Relational infrastructure

Relationships played a vital role in DiskCo's Oracle implementation, strengthening the organizational infrastructure. Many people in the DiskCo's Far East organization had worked there for quite some time, usually at least eight years. They had participated in earlier software projects. The IT and key users from Singapore site A had set up systems at sites in Malaysia and China. Some IT directors in China were originally from Singapore and had been hand-picked by executives there. Their shared history reduced the need for team building and fostering project commitment. It made the need for the Oracle conversion and the way the project would be organized more self-explanatory because people transposed their earlier experiences and way of organizing to the new project.

Prior collaboration meant that DiskCo staff acquired knowledge about their colleagues and the context they were working in. They knew the local terminology and the challenges other people faced. This influenced collaboration processes. It helped people identify with their (remote) colleagues. They could understand someone else's perspective and thereby communicate in a manner that acknowledged their colleagues' specific needs and expectations:

If you understand the background of people, it's much easier to work with them. If I know what term they should be using and what type of environment they are in, it's much easier for me to communicate with them . . . You can understand roughly what type of problem he or she will be facing. It's much easier that way. (Key User, Finance, ST, DiskCo-H-1)

Relationships simultaneously compress and enrich organizational communication. At DiskCo, executives from the USA had worked for a while in Singapore and Malaysia as part of their career track. Thus they established relationships with key executives and directors from these Far East sites. On an executive level, DiskCo's expatriate strategy paid off (Edström and Galbraith, 1977). When the Oracle project was initiated, executives from the USA had to work with professionals they had previously managed from corporate headquarters in

their country. Pre-established relationships and trust meant that half a word was enough to coordinate the project with the Far East sites. This worked both ways. First, when US executives asked Singaporean management to lead the project there, they could skip over many start-up issues like selecting the right person and elaborating on how they would like to shape US–Singapore communication. And second, when Singaporean executives escalated local issues to US headquarters, people there knew, without further queries, that it was a serious topic deserving attention:

We [DiskCo IT Singapore] have this new boss who came over [from the USA]. I worked with the new boss. And he is now the CIO [at DiskCo HQ in the USA]. He was my direct boss for two years in Singapore, and then he got promoted from Senior Director all the way to CIO in Singapore and went back to the USA. So that in terms of an IT high-level standpoint, I know him very well, he knows me very well. So for anything, I can just pick up the phone and call him up and say: 'I got this issue' . . . When he passes a task on to me, he knows that we can make it. And also when I tell him that I need this and this and this, he knows that I've really done all the necessary things before I ask for it. So he will not question me, like: 'Oh have you checked this, have you checked that?' He will just approve it. And that's a lot easier for us. (Vice President, Information Technologies, CPW, DiskCo-A-3)

A positive collaborative experience built relationships and trust between individuals, which positively contributed to converging individual mental models and create an organizational mindset. This seemed to have two effects. First, it economized interpersonal processes of explanation and monitored performance. The boss in the preceeding quote did not have to explain and ask a lot of questions. Second, the subordinate's point of view – implicit utterances like 'I got this issue' – can remain short yet carry meaning to those inside the relationship. In such relationships, several steps of conventional professional communication such as establishing the situation and the relationship may be skipped. This dual effect is of tremendous value in a distributed project where interaction suffers from constraints in terms of communication opportunities (time zone differences) and richness of electronic media.

Knowing a counterpart means that people build on a basis of common assumptions, mutual knowledge and shared norms. This familiarity on a meta-communication level (Watzlawick, Beavin Bavelas and Jackson, 1967) enhances or 'loads' their experience of an electronic medium (Carlson and Zmud, 1999). The relationship also accelerates the communication process since several steps in the socialization process may be skipped (Gabarro, 1990):

After you have seen the person [US counterpart] it's easier to work with them. They know you! Let's say you write an email to someone you don't know. But after you have talked to them and you have worked with them, you know the people well, so it's easier to work and communicate with them. Sometimes they

will just ignore you because they don't know who you are. You have to introduce yourself and what your responsibility is. (Member, Oracle Conversion Team, SCC, DiskCo-J-1)

A working relationship paves the way for discussing the challenging issues people face. This was important in the Oracle project where people were confronted with new technology and a tight implementation plan. Prior relationships at DiskCo made people find relevant counterparts faster and reduced interpersonal barriers to discuss unfamiliar topics:

The relationship is very important because that helps to improve the communications. Many times we hesitate to talk to somebody we are not familiar with. Especially you feel very uncomfortable telling them that you have a problem because you don't know what he is gonna think of you. But we really know each other so well since we were involved in all these projects. They all know that this guy is a master in this area, and this guy always helps us when we bring up an issue, and so forth. So that kind of understanding is already there, and that helps a lot because the communication flow is very smooth. (Vice President, Information Technologies, CPW, DiskCo-A-5)

According to this interviewee, the relational infrastructures reduced communication barriers thereby enhancing interaction. As a shared network, relationships helped people reduce initializing processes of interpersonal communication (whom to contact, how), and subsequent framing of novel issues. Relational infrastructure thus accelerated organizational communication at various stages of the interaction process.

## Discussion and Conclusion

Conceptualizing organizational communication in time-pressed, distributed temporary organizations is a challenging task. On the one hand, much of the communication literature assumes that people have opportunities for face-to-face, frequent contact. On the other hand, literature on virtual teams often focuses on misunderstanding (Cramton, 2001) and collaborative technology adaptation (Malhotra et al., 2001). We found no single theory that seemed capable of functioning as a backdrop for the complex psycho-social and socio-technical phenomena of distributed, collective work environments that operate under time constraints.

We adopted Bowker and Star's (2002) concept of infrastructure to capture the structuring of processes, and introduced two categories of infrastructures (organizational, relational) to refine our analysis of organizational communication under time pressure.

We examined our new frame of reference on the empirical DiskCo case study



and found that the sets of largely invisible infrastructures – organizational and relational – formed an intertwined complex web that supported day-to-day communication at DiskCo. The two sets of infrastructures were revealed through talk (interviews, observations), and sometimes visible traces (electronic and paper documents). Infrastructures comprise repertoires of genres that served dual roles in the structuring of activities: they rapidly enabled DiskCo's conventions to be spread globally to new project members, and through interacting with the genres, users could tailor them to the needs of their local situations. The infrastructures and repertoires of genres facilitated and accelerated socialization and collaboration in the temporary organization.

Salient features of infrastructures invoke their pervasive presence and embody company-specific norms and ideologies. Infrastructures shape and promote the speed of organizational communication in multiple ways. They shape, compress, enrich, and exclude discourse practices. Infrastructures accelerate interpretation and sense-making processes. They unload humans and facilitate inter-human processes, but they also increase pressure to continue and accelerate cycles of efficient discourse processes. Without these infrastructures, it would be very difficult for distributed temporary organizations to resolve the inherent dilemma of having to come up with novel and creative solutions on the one hand and working under tight time constraints across multiple cultural boundaries on the other.

The research reported here has conceptual and empirical limitations that would motivate additional studies. Conceptually, the notion of infrastructures could be further embedded in organization theory. Infrastructures could expand the concept of genres of organizational communication (Yates and Orlikowski, 1992). For instance, in their various relationships people may develop specific modes for communicating as part of their relational infrastructure (Gabarro, 1990; John-Steiner, 2000).

Empirically, this study has looked at a single implementation of ERP in a US corporation in the Far East. The results can therefore only be conceptually generalized (Yin, 1994). More research is required for investigating similar projects at other sites, and cross-continent projects that involve people from highly diverse backgrounds. The data collection was limited to executives, managers and key users. Future inquiry may extend this scope to include users and other stakeholders, whose voices are of importance in building, enacting and using infrastructures.

An infrastructure perspective has proven a fruitful framework for researching organizational communication under constraints. Today's high-paced economic systems often demand excessive contributions from humans who operate within multi-dimensional constraints (Simon, 1991) – physical, emotional and temporal. The potential gap between what humans can offer and what institutions demand leads to high-pressure performance and potential stress. Enhanced

performance expectations demand elevated communication levels for which opportunities do not abound.

Finally, further issues that remain unresolved are around how infrastructures may affect creativity and innovation in a distributed organization (Ciborra, 1996). Räisänen and Linde (2004) have shown how project-management models may be re-engineered to serve as managerial control tools. Further research needs to look at the issues addressed in this article from top-down and bottom-up perspectives. Moreover, more research is needed on the scope and the contextual and temporal horizons of infrastructures. We need to know more about how people activate and adapt infrastructures and how, over time, infrastructures may get rusty when people do not use them – like ancient languages that cease to exist, or people no longer using foreign languages they learned at secondary school. In other words, the perishability of infrastructures and their ‘renewal’ is a topic that deserves our attention, particularly in today’s fast-moving world.

### Notes

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1. The terms ‘temporary organization’ and ‘project’ are used interchangeably (Bryman et al., 1987; Meyerson, Weick and Kramer, 1996). The same applies to ‘distributed’ and ‘dispersed’.
2. At a late phase in our research we found that during workshops on Distributed Collective Practice involving an international community of scholars, people suggested related concepts as dimensions for research. See the following web sites for interesting contributions: <http://www.limsi.fr/WkG/PCD2000/indexeng.html>, <http://weber.ucsd.edu/~gbowker/colloque>, and <http://www.limsi.fr/Individu/turner/>. Our study conceptually elaborates this perspective, and empirically investigates the relevance of infrastructures in a time-pressed distributed organization.
3. Meaningful to those forming a relationship.
4. Referred to as Singapore site A.
5. This code uniquely identifies data sources, including a reference to interviewees.

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